



Advanced Research Systems, Inc.

MODEL ARS-2 HELIUM COMPRESSOR

TECHNICAL MANUAL

www.arscryo.com

CONTENTS

Contents	i
SPECIAL NOTICES	ii
SAFETY	iii
1. COMPRESSOR SPECIFICATIONS	1
2. COMPRESSOR INSTALLATION	2
3. COMPRESSOR OPERATION	3
Flow Diagram for the Model ARS-2W (Water Cooled)	3
Flow Diagram for the Model ARS-2A (Air Cooled)	4
4. MAINTENANCE PROCEDURES	5
4.1 Scheduled Maintenance.....	5
4.2 Unscheduled Maintenance.....	6
4.3 Self Sealing Couplings.....	8
4.4 Gas Cleanup	9
5. ELECTRICAL COMPONENTS	11
Schematic.....	11
Component Location.....	12
6. TROUBLESHOOTING	13
7. CONTACT INFORMATION	15

SPECIAL NOTICES

Three types of special notices – warnings, cautions, and notes – are used in the chapters of the refrigeration system manuals. They appear as follows and serve the purposes stated.



WARNINGS CALL ATTENTION TO ACTIONS OR CONDITIONS WHICH CAN RESULT IN INJURY TO PERSONNEL.

CAUTION

CAUTIONS CALL ATTENTION TO ACTIONS OR CONDITIONS WHICH CAN RESULT IN DAMAGE TO THE EQUIPMENT OR IN ABNORMAL PERFORMANCE.

NOTE

Notes give important, additional items of information related to but not truly a part of the procedure or discussion presented.

Warnings and cautions, like safety instructions, appear in the text where they are especially applicable. Because of their importance, they are summarized in the Safety section – the first section to be read.

SAFETY

WARNING

HIGH VOLTAGE is present within the system and can cause severe injury from electrical shock. Permit only qualified electrical technicians to open any electrical enclosure to perform electrical troubleshooting.

WARNING

HIGH GAS PRESSURE is present within the system and can cause severe injury from propelled particles or parts. Vent the compressor before removing or opening any parts, except when disconnecting the Aeroquip Self Sealing Couplings.

WARNING

DO NOT RECHARGE the system without using a pressure regulator.

WARNING

Always disconnect the crycooler from all sources of electrical power before performing any maintenance or troubleshooting procedures.

WARNING

Depressurize the absorber before disposing of it. Attach the depressurization fitting (included in the Installation Tool Kit) to the coupling half at either end of the absorber and tighten it slowly.

WARNING

The compressor motor is hot after operating. Wait for the motor to cool down before working on the inside of the compressor.

1. COMPRESSOR SPECIFICATIONS

DIMENSIONS

Length	19.00 Inches (483 mm)
Width	19.60 Inches (495 mm)
Height	16.00 Inches (406 mm)

WEIGHT

150 LB. (68KG)

POWER REQUIREMENTS

<u>MODEL</u>	<u>VAC</u>	<u>HZ</u>	<u>PHASE</u>	<u>AMPS</u>
ARS-2 Water Cooled	208/230	60	1	15
ARS-2 Air Cooled	208/230	60	1	15
ARS-2 Water Cooled	220/240	50	1	15
ARS-2 Air Cooled	220/240	50	1	15

HELIUM PRESSURE

Static:	190 +/- 5 PSIG
Operating:	250 +/- 5 PSIG (Supply)

INTERFACES

- Cold Head Power Connector: Mates with DE-202/DE-204 Interconnect Cord
- Compressor Input Power: Power Cord is equipped with Hubbell No. 5666C plug (NEMA 6-15)
- Helium Connections: ½ Inch Male Aeroquip Coupling

ABSORBER REPLACEMENT SCHEDULE

10,000 Hours (Per Elapsed Time Meter)

COOLING WATER

0.4 GPM, 80°F Maximum Inlet Temperature

AIR COOLING

Air Cooled units must maintain a minimum clearance of at least 12 Inches at both the front and rear grills.

2. COMPRESSOR INSTALLATION

1. Connect the power cable to a suitable connector or disconnect box making sure that the compressor on-off switch is off. Only qualified electrical service personnel that are familiar with all national, state and local codes should perform this work.
2. Cooling Water
 - a. Typical municipal drinking water is recommended.
 - b. 0.4 to 0.5 GPM is required to achieve a maximum discharge temperature of 100 Degrees F; with 80 Degrees F considered ideal.
3. Verify that helium pressure is between 190 +/- 5 PSIG. If pressure is low, refer to page 10 for charging procedure.
3. With the cover in place and cooling water on for Water Cooled and front and rear grills clear on the Air Cooled, start the compressor and run for 15 minutes to stabilize the compressor oil inventory.
5. The compressor is now ready to be connected to the cold end. See Figure 2.1.

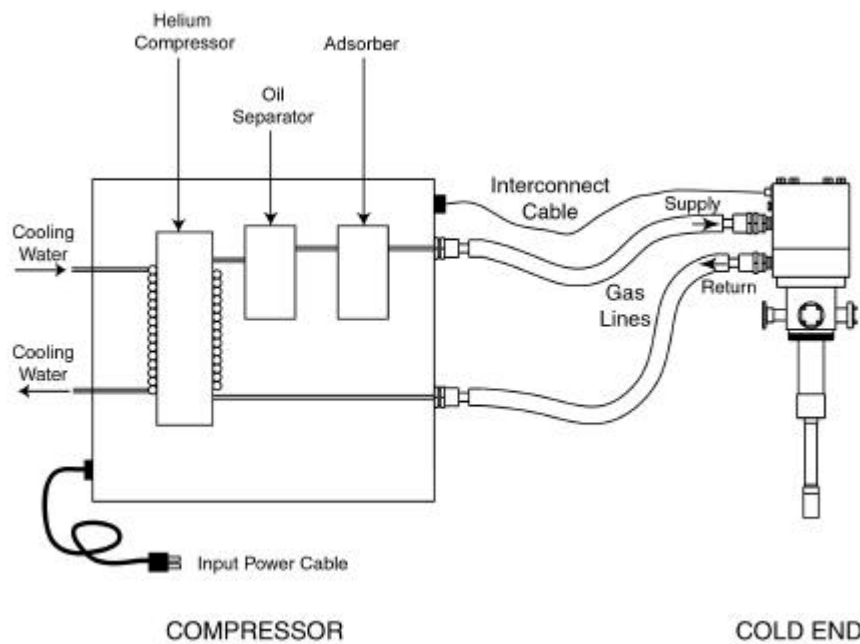


Figure 2.1 Compressor / Cold End Connections

3. COMPRESSOR OPERATION

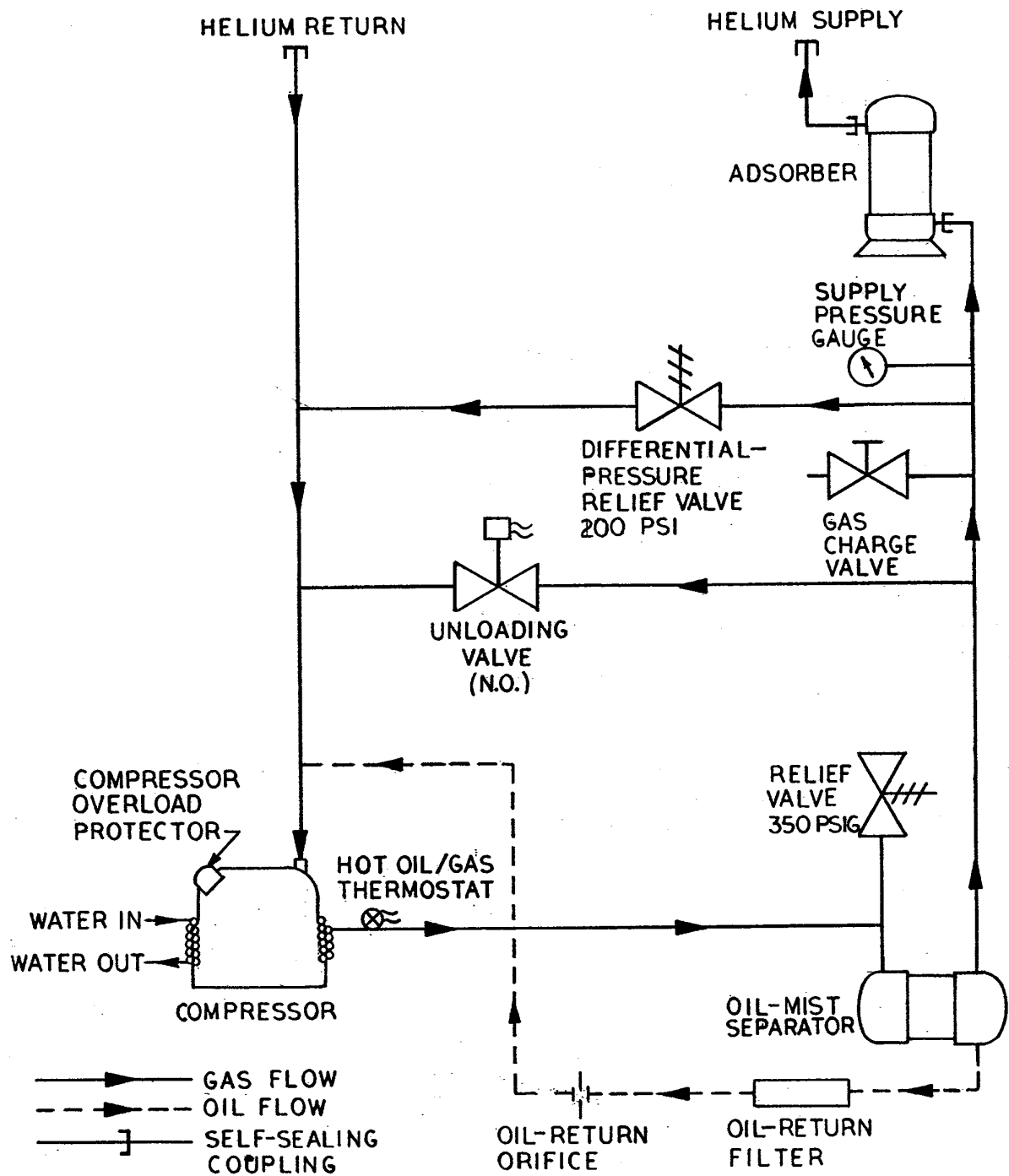


Figure 3.1 Flow Diagram for Model ARS-2W (Water Cooled)

3. COMPRESSOR OPERATION

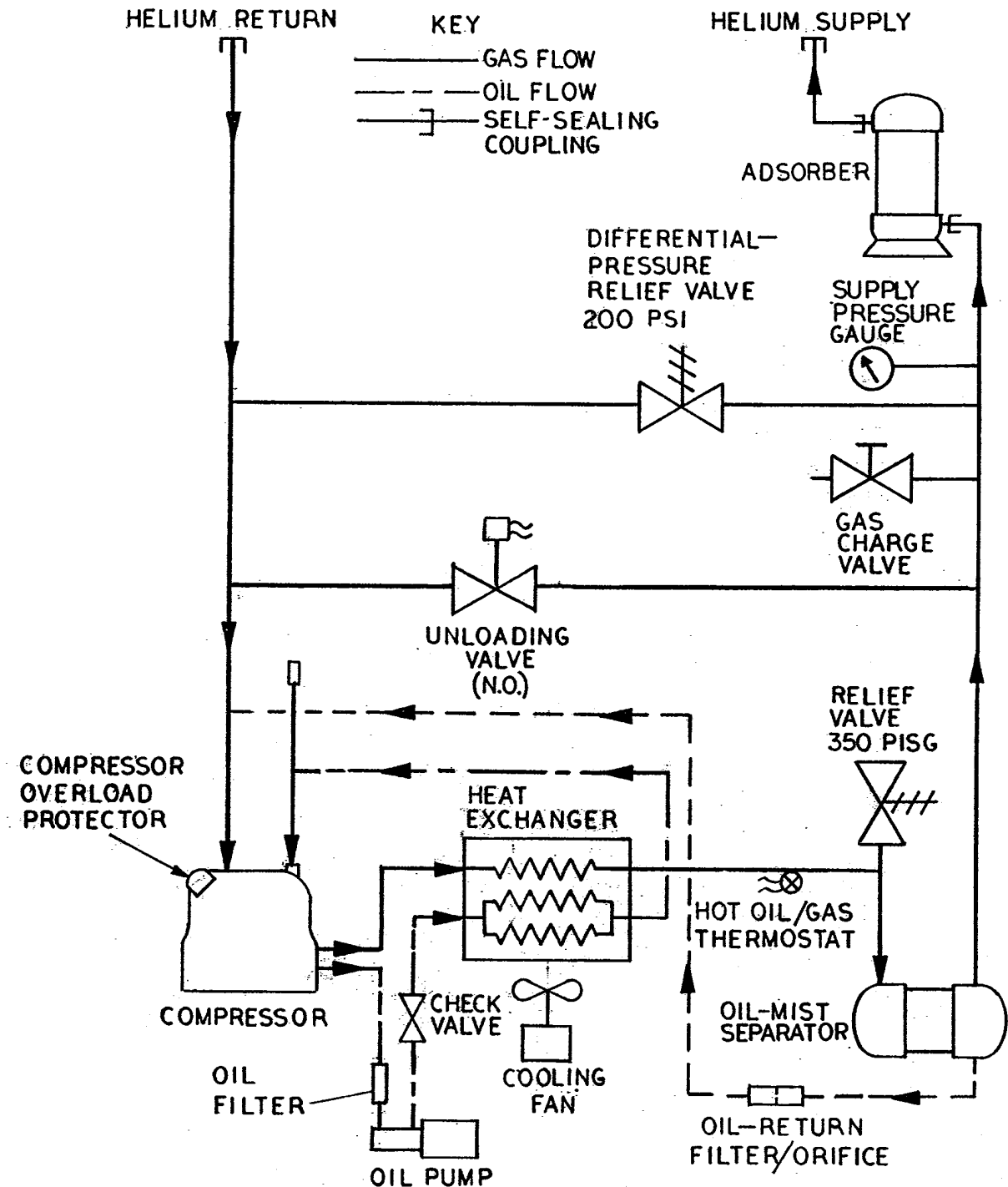


Figure 3.2 Flow Diagram for Model ARS-2A (Air Cooled)

4. MAINTENANCE PROCEDURES



Always disconnect the cryocooler from all sources of electrical power before performing any maintenance procedures.

4.1 Scheduled Maintenance

The only scheduled maintenance required on the Model ARS-2 Compressor is replacement of the compressor adsorber (AD-125) after every 10,000 hours of operation as indicated on the compressor elapsed time meter. When the compressor is used with 50 Hz power, the actual elapsed time will be 1.2 times that which is shown on the meter. To remove and replace the compressor adsorber proceed as follows:

1. Turn off the compressor.
2. Use the two wrenches supplied in the Installation and Maintenance Tool Kit to avoid loosening the body of the coupling from its adapter. Hold one wrench fast on the coupling half attached to the rear side of the compressor. Use the other wrench to loosen the coupling to the helium supply line. (Unscrew the two self-sealing coupling halves quickly to minimize minor gas leakage).
3. Remove cover.
4. Remove the adsorber from the compressor unit according to Figure 4.1. Save all nuts, bolts and washers for installing the replacement adsorber.



Depressurize the adsorber before disposing of it. Attach the depressurization fitting (included in the Installation Tool Kit) to the coupling half at either end of the adsorber and tighten it slowly.

5. Install the replacement adsorber as follows:
 - a. Remove the dust caps from the self-sealing coupling halves at each end of the replacement adsorber.
 - b. Check the self-sealing connector flat rubber gasket to make sure that it is clean and properly positioned.
 - c. Install the replacement adsorber as shown in Figure 4.1, in reverse order. Use the hardware saved in step 4 above.
 - d. Using the two wrenches supplied in the Installation and Maintenance Tool Kit, make the connection quickly to minimize minor gas leakage.

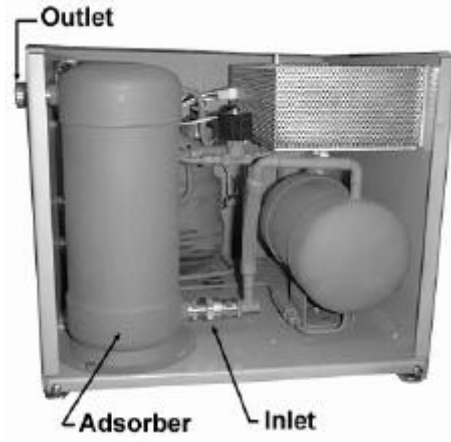


Figure 4.1 Adsorber Replacement

CAUTION !

Make sure to hold fast on the left nut while tightening.

- e. Make the first turns by hand and then firmly seal the connection using the two wrenches until the fittings “bottom”. Refer to Figure 4.2 for proper coupling of the self-sealing connection.
6. Replace the cover and flex-line. Make sure that the cover is installed so that it depresses the safety interlock switch. The compressor cannot be started unless this switch is depressed.
7. Insure that the supply pressure gauge reads 190 +/- 5 psig. If additional gas pressure is required, follow the instructions in Section 4.2, under Adding Helium Gas.
8. Add 10,000 to the reading on the elapsed time meter and write this total on the decal provided with the replacement absorber. This decal can be affixed to the front of the compressor.

4.2 Unscheduled Maintenance

Adding Helium Gas

CAUTION !

If the compressor helium pressure gauge reads 0, decontamination is required, refer to Gas Cleanup Procedure, Section 4.4.

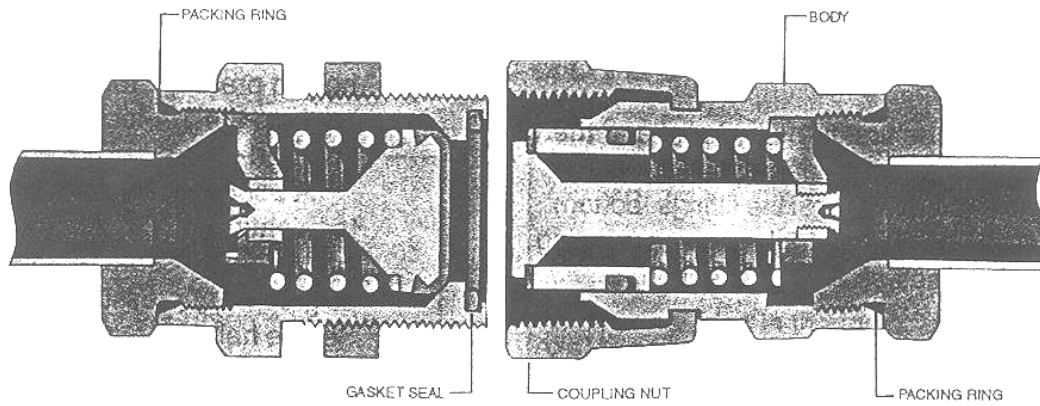
If you need to add helium more than once every several months, check for leaks caused by improperly connected self-sealing connections or incorrectly seated charge valves.

Use only 99.999% pure helium gas.

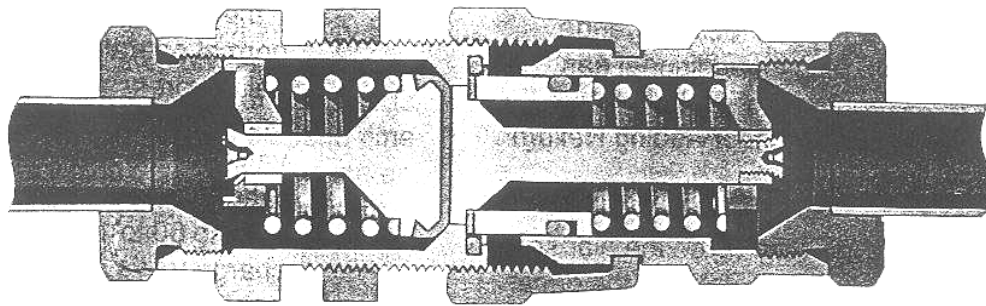
To add helium gas:

1. Remove the flare cap of the gas charge fitting on the rear of the compressor.
2. Loosely attach a charging line from the helium pressure regulator on the helium bottle to the ¼ Inch male flare fitting installed on the helium charge valve. A user-supplied helium charging line terminating in a ¼ Inch female flare fitting, and a pressure regulator rated at 400 psig delivery pressure is required.
3. Set the helium pressure regulator to 10 to 25 psig. Allow helium gas to flow through the charging line and around the loosened flare fitting for 30 seconds to purge the charging line of air. Then tighten the flare nut at the end of the charge line.
 - a. If the compressor is running under normal operating conditions, set the helium pressure regulator to 325 psig and slowly open the helium charge valve on the rear of the compressor. When the helium supply pressure gauge rises to 250-260 psig, tightly close the charge valve.
 - b. If the compressor is not running, set the helium pressure regulator to 250 psig and slowly open the helium charge valve. When the helium supply pressure gauge rises to 190+/-5 psig, tightly close the charge valve.
4. Insure that the helium charge valve on the compressor is tightly closed. Then shut off the helium pressure regulator on the helium bottle. Remove the charging line from the male flare fitting and reinstall the flare cap.

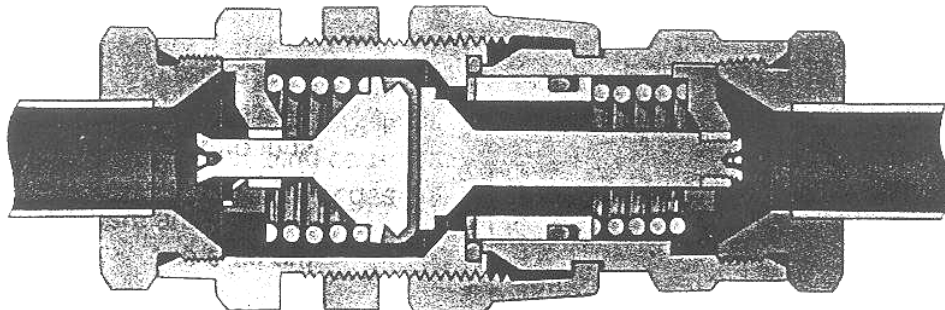
4.3 Self Sealing Aeorquip Couplings



Coupling Halves Disconnected



Coupling Halves Partially Connected



Coupling Halves Fully Connected

Figure 4.2 Cross Sectional View of Self-Sealing Coupling

4.4 Gas Cleanup

Gas cleanup is required if the compressor's interior has been opened to the atmosphere or the equalization pressure is 140 kPa (20 psig) or lower. Gas cleanup is performed with the compressor disconnected from the other system components. The adsorber must be disconnected unless it also has been opened to the atmosphere or its charge pressure is less than 140 kPa (20psig).

NOTE

If the compressor's interior has been exposed to the atmosphere for an extended period, gas cleanup may not suffice to guarantee system gas purity. Adsorber replacement will be required.

1. Disconnect the gas lines from the compressor. Screw dust plugs into the disconnected gas line couplings.
2. Locate two adapter fittings P/N 255919B2. Be sure their valves are closed. Attach them to the supply and return Aeroquip couplings on the compressor.

NOTE

A vent adapter will be required. If the adsorber has been disconnected, connect the adapter fitting with male coupling to the supply line from the oil separator, for venting during this procedure. If the adsorber will not be disconnected, attach the adapter fitting to the compressor's helium supply (outlet) coupling.

3. Connect a charge line to the pressure regulator of a helium gas cylinder containing 99.995% pure helium gas with a dew point less than -50°C (-58°F) at 2070 kPa (300 psig). Adjust the gas cylinder pressure regulator to 35 kPa (5 psig). A user-supplied $\frac{1}{4}$ inch female flare fitting is required at the end of the charge line.
4. Remove the flare cap of the gas charge fitting on the rear of the compressor while connecting the charge line to the compressor's charge coupling, thoroughly purge the charge line from the regulator. It is important to remove all air contaminants to prevent them from entering the system.
5. Adjust the pressure regulator to 1310 kPa (190 psig). Open the valve on the charge fitting and charge the compressor to 1310 kPa (190 psig).
6. Close the valve on the charge fitting.
7. Run the compressor for at least 30 minutes to heat the oil to operating temperature. Stop the compressor. Adjust the pressure regulator to 690 kPa (100 psig).

8. Adjust the pressure regulator to 690 kPa (100 psig).
9. Open the vent valve on the supply coupling of the compressor. Watch the compressor's pressure gauge. When the pressure falls to 35 to 70 kPa (5 to 10 psig), close the vent valve. Open the gas cylinder valve to increase the pressure to 690 kPa (100 psig). Close the charge valve.
10. Repeat Step 9 five (5) times.
11. Adjust the pressure regulator to 1310 kPa (190 psig).
12. Open the charge valve and charge the compressor to the equalization pressure. Close the charge valve. Start the compressor.
13. After running 30 to 45 seconds, stop the compressor. Open the vent valve and vent the compressor to 35 to 70 kPa (5 to 10 psig). Close the vent valve.
14. Repeat Steps 12 and 13 five (5) times, then go to Step 15.
15. Open the charge valve. Charge the compressor to the equalization pressure. Close the charge valve.
16. Allow the compressor to cool. Read the pressure gauge with the compressor at 20° C (68° F). Adjust the equalization pressure by charging or venting to conform to the Specification.
17. Close the gas cylinder valve and adjust the pressure regulator to zero psig.
18. Disconnect the charge line from the adapter fitting. Store the charge line to keep it clean.
19. Remove both adapter fittings. Reconnect the adsorber if it has been disconnected prior to gas cleanup. Torque the Aeroquip coupling to 1.4 to 2.1 kgf m (10 to 15 ft. lbs.).
20. If other components need cleaning, refer to the procedures in their technical manual. Otherwise, reconnect the supply and return gas lines to the compressor. Torque the gas line couplings to 4.85 ± 0.7 kgf m (35 ± 5 ft. lbs.).

5 ELECTRICAL COMPONENTS

Electrical Schematic Diagram

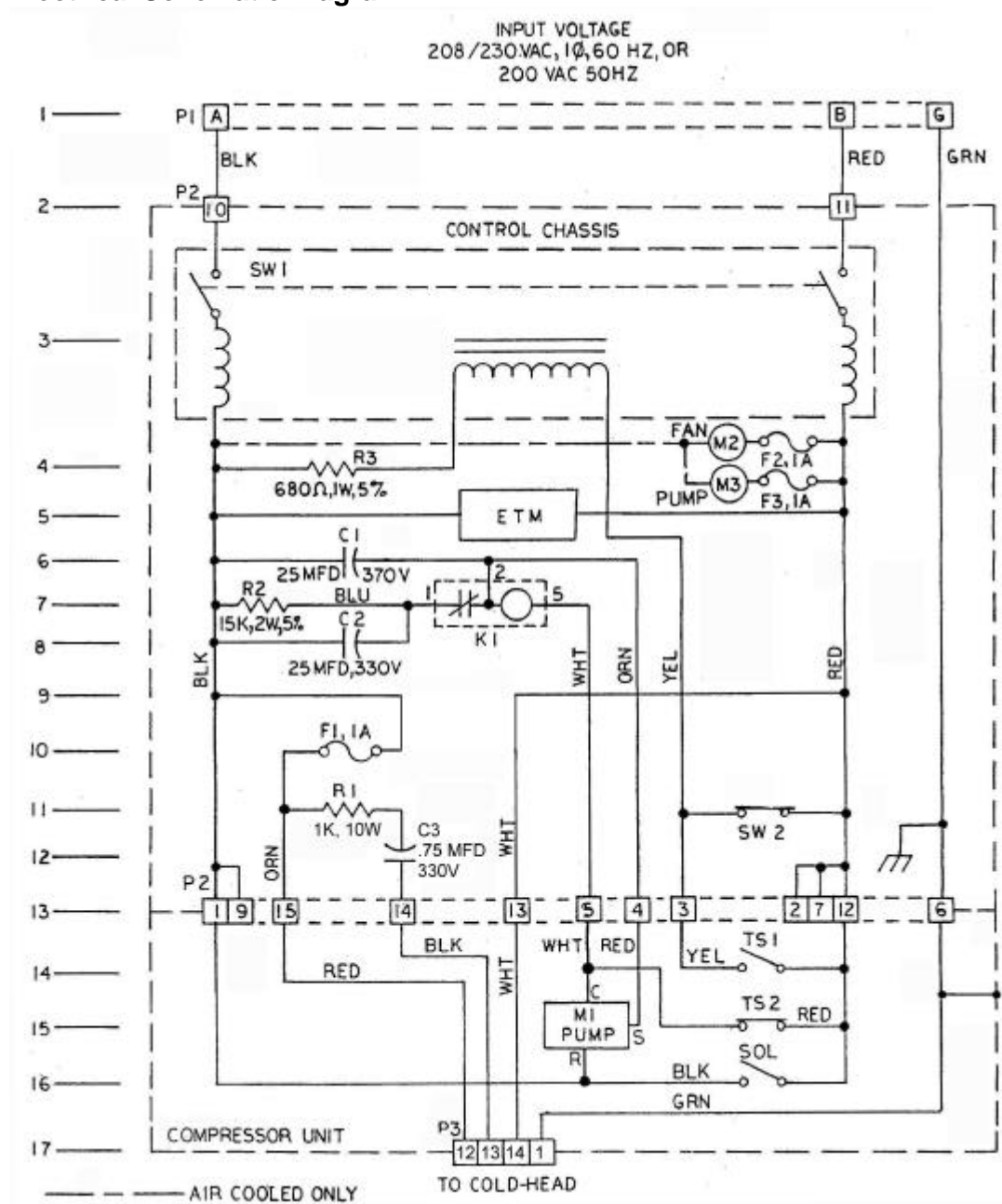
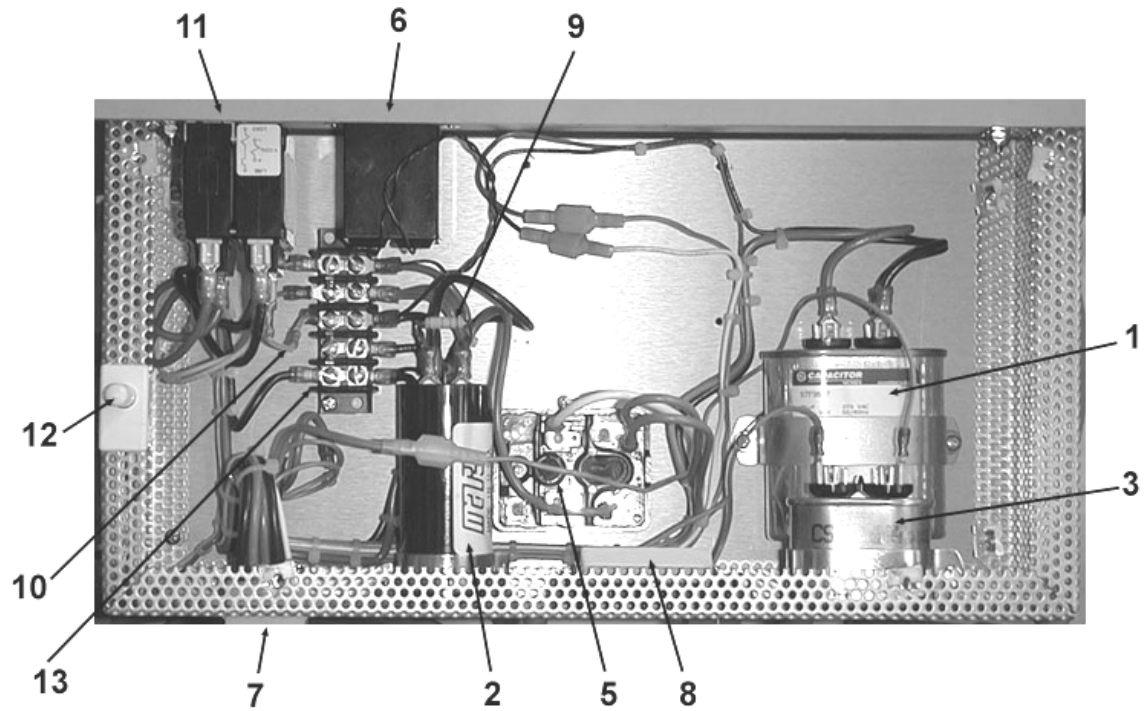


Figure 5.1 Electrical Schematic for Model ARS-2

Electrical Component Location



Item	Description	Ref. Desig.
1	Capacitor, Run	C1
2	Capacitor, Start	C2
3	Capacitor, Cold Head	C3
4	Fuse, 1Amp (Located Beneath Item 7)	F1
5	Relay, Start	K1
6	Meter, Elapsed Time	M1
7	Connector, 15 Pin Chassis	P2
8	Resistor, 1K ohm, 10 W	R1
9	Resistor, 15K ohm, 2 W	R2
10	Resistor, 680 ohm, 1 W	R3
11	Switch, Compressor "On-Off"	SW1
12	Switch, Safety Interlock	SW2
13	Terminal Block	TB1

Figure 5.2 Electronic Control Chassis

6. Compressor Troubleshooting



Disconnect the compressor from its power source before performing any troubleshooting procedures.



The compressor motor is hot after operating. Wait for the motor to cool down before working on the inside of the compressor.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
1) The compressor ON/OFF switch (SW1) remains in the ON position when switched on but the motor does not run.	1) No power coming from the power source. 2) Incorrect or disconnected wiring within the compressor.	1) Check service fuses, circuit breakers and wiring associated with power source and repair as needed. 2) Check the compressor against its electrical schematic, Figure 5.1.
2) The compressor ON/OFF switch (SW1) will not remain in the ON position.	1) The safety interlock switch (SW2) is open. 2) Thermal protective switch TS1 is open. 3) High current has activated the overload trip in the compressor ON/OFF switch.	1) Securing the compressor cover may correct the problem. If not, check for proper operation of safety interlock switch (SW2) located on the top right side of the electronic control chassis. 2) Confirm that switch TS1 is closed. 3) Contact the Service Department for assistance.
3) Compressor stops after several minutes of operation and remains off.	1) High temperature of the compressor is caused by insufficient cooling water, resulting in the opening of thermal protective switch (TS1). 2) After turn-off, very cold cooling water was left running through the compressor.	1) Confirm that sufficient cooling water to the compressor is flowing. 2) Turn on the compressor and allow it to run until it has stopped several times, allowing the oil temperature to rise and the compressor to operate continuously.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
3) Compressor stops after several minutes of operation and remains off(cont).	3) Insufficient helium pressure as indicated by the supply pressure gauge.	3) Add helium per Section 4.2, Unscheduled Maintenance.
	4) Very cold cooling water was circulating through the compressor while the unit was turned off.	4) Turn the compressor on, let it run until it stops. Repeat until the oil temperature rises enough to allow the compressor to run without shutting down.
	5) High temperature of the compressed helium in the discharge line from the compressor pump has tripped the thermal protective switch (TS1).	5) Recheck for proper cooling water and cooling air conditions per Table 1.1.
	6) Low power source voltage.	6) Confirm that power source voltage is correct, and restore voltage if necessary.
	7) Failure of the unloading valve Solenoid.	7) Contact the Service Department.
	8) Mechanical seizure.	8) Turn the compressor OFF and electrically disconnect the solenoid coil from the rest of the circuit (see electrical schematic, Figure 5.1). Use an ohmmeter and check the coil for continuity. If continuity does not exist, contact the Service Department.
		9) Contact the Service Department.

7. Contact Information

Advanced Research Systems, Inc.
905 Harrison St.
Allentown, PA 18103
USA

Telephone: (610) 439-8022
Fax: (610) 439-1184
Email: ars@arscryo.com
Web: www.arscryo.com